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ABSTRACT

This paper is an attempt to clarify the ambiguity surrounding the issue of adult creativeness. The significance and the limitations of the Genetic Epistemological paradigm in the conceptualization of adult inventiveness are discussed. A framework is suggested that provides an alternative for the study of adult creativeness from a cognitive-structural orientation, reconciling traditional developmental theory with a nontraditional approach to the definition and study of inventiveness. The paper also examines hypothesized post-formal thought structures and their relevance to the understanding of adult creativity. A study is reported that was undertaken to investigate the possibility that the problem-finding stage of cognitive development is inseparable from creativity. Data are shown that imply that problem finding is a critical component in the creative process. (YLB)

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A Cognitive-structural Approach To Adult Creativity

This paper represents an attempt to clarify the ambiguity surrounding the issue of adult creativeness. The significance, as well as the limitations, of the Genetic Epistemological paradigm in the conceptualization of adult inventiveness will be discussed. A framework will be suggested which provides an alternative for the study of adult creativeness from a cognitive-structural orientation, reconciling traditional developmental theory with a non-traditional approach to the definition and study of inventiveness. This will include an examination of hypothesized post-formal thought structures and their relevance to the understanding of adult creativity. For all intents and purposes, this presentation will originate from the position that creativity represents a compilation of multiple traits: "exceptional versions of familiar mental operations such as remembering, understanding and recognizing" (Perkins, 1981, p.231).

It has been suggested (Feldman, 1983) that for a comprehensive developmental theory of cognition to exist, great achievements, as exemplified by giftedness in a domain must be accounted for along with common, universal developmental advances. Therefore, in order to understand creative behavior it is essential to comprehend the cognitive events which mediate interactions between persons and their environments during the normal acquisition of developmental stages.

Essential Elements of the Piagetian Model

According to Piaget, cognitive change results from the active

restructuring of pre-existing mental schemes to adapt to the constantly changing external environment. Adaptation consists of two inaissociable, complementary aspects, assimilation and accomodation.

Assimilation can be likened to the manner in which an individual, upon perceiving a doberman pincher for the first time incorporates this creature into an existent scheme for canines. However, when first encountering the highly novel, discrepent dachshund an adaptation, or accomodation, of the canine scheme might become necessary. In this manner a disequilibrium between existent cognitive structures and "'non-assimilable' data not previously attended to ..." (Flavell, 1977 p. 242) provides impetus for a reorganization of cognitive structures.

Attending to highly novel, highly discrepent stimuli throws existent, inadequate cognitive schemata into a state of flux which can be re-equilibrated through an active process of reflective abstraction to attain equilibrium at a higher developmental level (Cohen, 1986). In this process, lower level knowledge is projected to a higher level while simultaneously accomodating novel elements to achieve a metaphorical integration, what Piaget referred to as a (Type 3) Hierarchical Equilibration of Totalities (Cohen, 1986). Piaget identified this incremental cognitive restructuring as an " augmentative equilibration," an important form of re-equilibration which does not lead back to a previous state , but to a better adaptation" (Inhelder, 1982, p.42 cited in McAllister, 1986). Augmentative equilibration is therefore the mode through which persons advance to a more complex, comprehensive state of cognition.

Extraordinary sensitivity to novel stimuli is generally accepted as a common ability shared amongst creatives (e.g. Cohen,

1986; Guilford, 1968; McAllister, 1986; Perkins, 1981). This ability may be enhanced by several factors including the ability to synthesize and analyze information from diverse domains, and exceptional evaluative skills (Guilford, 1968). Furthermore, it has been suggested (Gamble and Keller, 1968; Noppe, 1985) that the attainment of formal operations plays a critical role in the recognition of novelty and the creative solution of problems.

Formal Operations

Formal operations has been identified as the final stage in Piaget's theory of cognitive development (Piaget, 1972). Formal thinkers are capable of solving problems by generating abstract hypotheses detached from the physical manipulation of objects. These hypotheses are systematically subjected to empirical investigation, often through the use of proportionality and combinatorial systems (Piaget, 1972; Arlin, 1975). This hypothetico-deductive approach to problem solving is generally viewed as a necessary, yet insufficient condition for the abstract reasoning required for creative performance within a domain (e.g. Arlin, 1975; Saarni, 1973; in Noppe, 1985).

Piaget recognized the importance of experiential factors in cognitive development, contending that the attainment of formal operations is domain specific: persons "reach this stage in different areas according to their apptitudes and professional specializations" (Piaget, 1972 p.9). He explained this domain specificity as the consequence of the diversification of life experiences which increases between the ages of 15 and 20 years (Piaget, 1972). Implicit in this statement is the concept that persons differ in the domains they select, as well as in the levels of sophistication that they achieve within these domains (Feldman, 1980, 1982 cited in 1983). This implies

that creativity, when defined as gifted performance within an area of knowledge, is significantly influenced by learning as a result of increased specialization in adulthood. This viewpoint leads Feldman to redefine creativity in the following manner: 'novel reorganizations of specific domains, reorganizations that have the effect of changing the domain even as they change the individual achieving them' (1983, p.9).

In sum, the literature suggests that the attainment of formal operations is a necessary, yet insufficient condition for gifted performance within a domain. The importance of experential factors implies that creativity can best be viewed as resulting from a reciprocal relationship between the individual and the environment. Perhaps this interaction of human disposition and experiential factors is best summarized by Perkins (1981): "the preselections of the maker's history and the histories of the culture, the species, and the physical world channel what the maker will attempt and equip the maker with the skills and schemata to attempt it.

Additionally, it has been suggested that formal thinkers who performed well on a battery of creative tasks possessed the ability to selectively regress to more primitive stages of cognition, allowing a general, discovery oriented approach to problem solution (Noppe, 1985). Piaget himself stressed the need to adopt a naive curiousity and candor toward discovery, similar to that of a young child, when attempting to solve difficult problems (Noppe, 1985). What seemingly constitutes cognitive regression has also been viewed as progression, evidenced only by a select number of individuals who have re-equilibrated beyond the stage of formal operations.

Post-formal Operations

Arlin (1984) identifies cognitive structures, arising early in

adulthood, which do not readily conform to the traditional framework of formal operations. Based upon research findings (e.g. Arlin, 1975, 1977) she suggests that these styles may constitute a fifth, more advanced stage of cognitive development termed post-formal operations. Furthermore, Arlin states that "this fifth stage may best characterize creative thought, the envisioning of new questions, and the discovery of new heuristics in adult thought" (Arlin, 1975, p.606).

As previously mentioned in relation to creative formal thinkers, persons in the hypothesized stage of post-formal operations are characterized by their ability to selectively regress through all previously acquired operations. A post-formal thinker is no longer bounded by the maximal operations characteristic of a certain cognitive stage. Rather, one is free to access operations at all levels to arrive at a 'best fit' for both the creative formulation and solution of problems (Arlin, 1984). Accordingly, persons at this level are able to adopt a naive curiousity and candor toward discovery, earlier alluded to by Piaget in relation to creatives in general (Noppe, 1985).

Unlike the hypothetico-deductive reasoner, a post-formal thinker is not constrained to initiating possibilities and hypotheses merely in the presence of problematic situations. Instead, individuals at this level can coordinate knowledge from multiple domains relativistically into an infrastructure, culminating in the formulation of general, generic questions from "ill-defined problems" (Arlin, 1984, p.264). It is this behavior, identified as problem-finding, which is believed to distinguish post-formal thought from the problem-solving strategies employed in the the four Piagetian stages. However, the synthesis of knowledge from diverse domains into a unitary system is reminiscent of the process of reflective abstraction (Cohen, 1986), and

is generally accepted as a key factor in creative production (e.g. Arlin, 1984; Cohen, 1986; Perkins, 1981).

In addition to problem-finding, Arlin (1984) identifies dialectical operations as an important component of post-formal reasoning. This essentially refers to a tendency to tolerate and attend to novel, contradictory, environmental aspects, a trait earlier described in relation to creativity (McAllister, 1986).

Based upon a review of the literature it becomes evident that there is a high degree of parity between problem-finding, as identified with post-formal reasoning, and several factors implicated in creative production at other cognitive stages. Numerous researchers have concluded that the attainment of formal operations is a necessary condition for creativity. Moreover, the general, generic approach to problem formulation and solution has been viewed as both a cognitive regression from formal operations and as a progression to higher stage of cognition. Taken together these differing views suggest an alternate explanation. Problem-finding may be essential for creative discovery at all stages of development, although more overtly manifest and measurable only in higher levels of cognition.

Implicit in this thesis are 2 crucial assumptions. First, it assumes that problem-finding and formal thinking need not be systematically related. Evidence supporting this would indicate that the attainment of formal operations is not a necessary precondition for the attainment of problem-finding behavior. In essence, such findings would contradict Arlin s (1975) results which led her to conclude that formal operations is a necessary yet insufficient condition for problem-finding. Furthermore, this would prohibit the problem-finding component of post-formal thought from fulfilling the sequential

criterion of developmental stage theory, which mandates that behaviors appropriate to the preceding stage be accomplished prior to the emergence of the new stage. Second, the thesis assumes that post-formal structures and creativity are highly intercorrelated. Evidence for the second assumption would account for the theoretical similarities, evident in the literature, between problem-finding and creative performance.

Based upon the possibility that problem-finding is inseparable from that which characterizes creativity, a study was undertaken. Subjects were assessed with regard to 3 variables: cognitive ability (formal operations), divergent production (creativity), and problem finding. If prob'em-finding is a unique component of a fifth stage of cognitive development, then only subjects well into formal operations should evidence this behavior. Conversely, if problem-finding is truly present throughout the lifespan there need not be any relationship to cognitive ability. Similarly, if creativity is separate from problem-finding little relationship is to be expected whereas, if they are inaissociably related a high score on either should account for a high score on the other.

METHOD

Sample

The sample for the study consisted of 25 male and female college students selected randomly from an introductory psychology student subject pool at a small, private institution in the Northeast. One subject was deleted due to the unscoreable nature of the responses provided, leaving a total of 24.

Instruments.

Cognitive Ability. The first independent variable, cognitive ability, was assessed by means of the Tomlinson-Keasey, Campbell Assessment. The 6 tasks included are designed to measure the following formal operations: proportionality, systematic searches, isolation of variables, correlation, probability and multiple transformation of information (Tomlinson-Keasey, Campbell, undated). The tasks were group administered and scored objectively in accordance with the rationale provided by Tomlinson-Keasey and Campbell.

Divergent Production. The second independent variable, divergent production (DP), was assessed through the use of 6 questions adapted from the DP category of Guilford's (1956) Structure of the Intellect Model (see Guilford, 1967). These were selected to sample the 6 major categories of DP and included the following: sketches test - DP of figural units, alternate uses - DP of semantic classes, alternate additions - DP of symbolic relations, four word combinations fluency - DP of semantic systems, symbolic production - DP of semantic

transformations, and possible jobs - DP of symbolic implications. The DP test was utilized based upon its widespread recognition as a successful method of operationalizing creative production in an objectively scoreable manner (Zegas, 1976). The tests were group administered and scored in accordance with Guilford's (1956) suggestions.

Problem-finding. The dependent variable, problem-finding (PF), was assessed through the use of the materials and methods developed by Arlin and Getzels (Arlin, 1975). The task consisted of 12 types of objects: 1 C-clamp, 1 black wooden cube, 1 plain wooden cube, 1 quarter, 1 boxtop, 1pair of scissors, 1 boxbottom, 3 candles, 3 wooden matches, 10 thumb tacks, and 2 six ft. cords. Earlier research indicates that this task is useful in differentiating between the formulation of a problem and the solution of an already formulated problem (Arlin, 1975, 1977).

The task was group administered and scored in accordance with Arlin's (1977) suggestions. The questions were analyzed according to the "intellectual products" categories of Guilford's (1956) Structure of the Intellect Model. Points were assigned to each question in the following manner:

1 pt. = Units

2 pts.= Classes

3 pts.= Relations

4 pts.= Systems

5 pts.= Transformations

6 pts.= Implications

Previous research indicates that the higher category questions (e.g. Implications) are of the general, generic type, characteristic of post-formal reasoning (Arlin, 1975,1977). Interrater reliability achieved through the independent classification of 9 tests by two scorers was .95.

Results

The results indicate that DP and PF are significantly related, $r(24) = .55$, $p < .01$. Additionally, the relationship between cognitive ability and PF is an insignificant one, as is that of cognitive ability and DP. Stepwise multiple regression analysis revealed that the relationship between cognitive ability plus DP, and PF was significant $F(24) = 4.63$, $p<.05$. However, the relationship between independent and dependent variables was increased by dropping out the cognitive ability factor. Thus, the resulting relationship between DP and PF was increased to $F(24) = 9.7$, $p<.01$.

Discussion

Firstly, the results of this study support the hypothesis that PF and DP are indeed closely related. The significance of the relationship between PF and DP empirically clarifies the theoretical overlap, evident in the literature, between these factors. This finding deserves further consideration since it may suggest that PF represents an important aspect within the creative process.

Secondly, the insignificance of the relationship between cognitive ability and PF is not supportive of conceptualizing PF as a component exclusive to a fifth stage in adult cognitive development. This finding seems contrary to Arlin's (1975) results which suggested that hypothetico-deductive reasoning structures may be a necessary

precondition of PF, yet it must be cautiously interpreted. Largely, these reservations are due to the homogeneity of the sample, in which all subjects were classifiable as formal operational with the possible exception of two. However, the weakness of the relationship can be tentatively interpreted as indicative of cognitive ability, within the stage of formal operations, not being systematically related to PF ability. One possible suggestion of this non-relationship is that PF is not an exclusive component of the hypothesized stage of post-formal operations. If this were the case only persons well into formal operations should evidence PF behavior, due to the sequential nature of developmental stage theory.

This finding also seems incongruent with Arlin's (1977) results based upon a sample of children classified as low-concrete, concrete, and transitional to formal operations. The results of this study led her to conclude that operational level and PF, measured in terms of question quality, were quite related.

In summary, the relationship between operational level and PF deserves further study utilizing subjects representative of all cognitive stages. This is necessary in order to identify whether persons in these stages exhibit PF behavior. The evidence presented in this paper appears to tentatively support the contention that structures identified as post-formal are not truly a structural stage of thought (Rybash, Hoyer and Roodin, 1986). Rather, the data imply that PF is a critical component in the creative process.

While not supportive of an additional stage of cognitive development this study clarifies Arlin's (1975) conclusion that "this fifth stage, the problem-finding stage, may best characterize creative thought, the envisioning of questions, and the discovery of new

heuristics in adult thought" (Arlin, 1975, p. 606). An alternative view, suggested by Rybash, Hoyer and Roodin (1986) is that post-formal thought is domain specific, its development limited by the extent of expertise in an area. Based upon the aforementioned importance of experiential factors this may provide the most accurate model for conceptualizing these structures, as well as a fertile area for research. Perhaps, pending further analysis, caution should be applied when utilizing the label of 'post-formal,' in reference to problem-finding styles of thought. Presently, it appears that problem-finding can be safely defined as a key factor in adult creativity.

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